

Combination of lumbar erector spinae plane block and transmuscular quadratus lumborum block for surgical anaesthesia in hemiarthroplasty for femoral neck fracture

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ABSTRACT

Femur neck fractures may occur in elderly patients with multiple co-morbidities. Spinal or general anaesthesia may not be safe in such patients, leading to a search for other safer alternatives. Herein, we report a case in which a never previously reported combination of quadratus lumborum block (QLB) and erector spinae plane block (ESPB) was successfully used as the main anaesthetic method for hemiarthroplasty. An 86-year-old female patient with severe aortic stenosis was scheduled for internal fixation or hemiarthroplasty due to right femoral neck fracture. Following sedoanalgesia, the patient was placed in lateral decubitus position and ESPB and transmuscular QLB were performed from the fourth lumbar vertebra level. Adequate and effective surgical anaesthesia was achieved and hemiarthroplasty was performed. The combination of lumbar ESPB and QLB can be used for the anaesthesia management in high-risk patients undergoing hemiarthroplasty.

Key words: Erector spinae plane block, hip surgery, quadratus lumborum block

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INTRODUCTION

Femur neck fractures are generally seen in patients with advanced age with co-morbidities which put them in high-risk category.^[1,2] Anaesthesia maintenance in these patients depends on physical status, medications and co-morbidities and is generally maintained with general or neuraxial anaesthesia.^[3,4] Erector spinae plane block (ESPB) is a recently described regional anaesthesia technique leading to multiple paravertebral blocks.^[5] On the other hand, quadratus lumborum block (QLB) is an effective regional anaesthesia technique used in abdominal and hip surgeries for postoperative analgesia.^[6] There are many modifications of QLB and its nomenclature changes according to these modifications, and differing local anaesthesia distribution means this technique can be used in various surgeries.^[7]

Herein, we report a patient in whom hemiarthroplasty was successfully performed under a combination of ultrasound-guided lumbar ESPB and QLB.

CASE REPORT

An 86-year-old female patient weighing 82 kg with 1-week-old right femoral neck fracture was scheduled for internal fixation or hemiarthroplasty. Medical history was significant for hearing loss, cerebrovascular event 7 years ago and severe aortic stenosis. Physical examination and laboratory tests were positive for Grade IV murmur on the aortic area and high serum creatinine (2.33 mg/dl). Peripheral arterial blood gases without O₂ support were as follows: pH: 7.40, PaCO₂: 38.3 mmHg PaO₂: 66.7 mmHg

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and O₂ saturation: 90%. Posterior-anterior chest X-ray showed right hilar widening, elevated left hemidiaphragm and an area of atelectasis/mass in the left basal segment. Initial electrocardiogram (ECG) revealed atrial fibrillation-flutter and a follow-up ECG demonstrated sinus rhythm. Patient was classified as being American Society of Anesthesiology Class 4. The patient and family were informed of the high risk of morbidity and mortality and written informed consent was obtained. After considering all comorbidities, general or spinal/epidural anaesthesia was considered to be of considerable risk. Therefore, a combination of peripheral nerve blocks was considered as alternatives. Premedication of 1 mg midazolam was performed. Invasive arterial pressure monitoring added to standard monitorisation plan.

Patient was placed in the left lateral decubitus position. After aseptic precautions and skin preparation, the fourth lumbar vertebral spinous process was identified, and a low-frequency convex transducer was placed 4 cm lateral to the midline on the parasagittal plane. The transverse process and erector spinae muscles were visualised. A 10 cm 22G needle was advanced using the out-of-plane technique. After contact with the transverse process, local anaesthetic (0.5% bupivacaine 20 ml, 2% lidocaine 8 ml and 12 ml isotonic saline) was administered. Thereafter, the transducer was placed in the transverse plane on the flank of the patient cranial to the iliac crest. The fourth lumbar vertebral transverse process, erector spinae psoas and quadratus lumborum muscles were identified. A 15 cm 22G needle was inserted on the posterior corner of the convex probe. Twenty millilitres of local anaesthetic (0.5% bupivacaine 10 ml, 2% lidocaine 4 ml and 6 ml isotonic NaCl) was administered between the quadratus lumborum and psoas muscles. This ratio of LA was chosen considering toxic levels of each component and is customised for this patient.

Following blocks, the patient was placed in the supine position. After 20 min, pinprick test revealed sensory block between T10 and L4 dermatomes. The patient was able to move her feet; however, there was no movement of the hip joint. The patient had no pain. There was no sensorial or motor block on the contralateral side, possibly excluding the presence of epidural spread. Surgery commenced at 35th min following nerve block. Partial hip prosthesis was performed in 2 h. Twenty-five micrograms of fentanyl was administered once for arterial line placement and once because of the slight increase in blood

pressure, making the total administered dose 50 mcg. Interventions involving the medial aspect of the femur, innervated by the obturator nerve, led to mild pain and increments of 10 mg of intravenous ketamine was given totalling 40 mg. Post-operative analgesia plan included paracetamol that was administered every 8 h. Examination at postoperative 12th h revealed no pain at rest or on movement. Numeric Rating Scale was $\leq 2/10$ for the first 16 post-operative hours during which time rescue analgesia was not required.

DISCUSSION

Herein, we have reported a case of hemiarthroplasty performed under combined ultrasound-guided lumbar ESPB and transmuscular QLB in a patient where general or neuraxial anaesthesia was not possible due to severe aortic stenosis and pulmonary comorbidities.

The hip joint is innervated by the ventral rami of the spinal nerve roots of the lower part of the lumbar plexus (L2–L4) and the upper part of the sacral plexus (L4–S1).^[8] The lateral femoral cutaneous nerve (LFCN) from the lumbar plexus (L2–L3), lateral cutaneous branch of iliohypogastric nerve (T12 and L1) and subcostal nerve (T12 thoracic nerve) innervate the area of the superior lateral gluteal region and the proximal lateral thigh that are involved in skin incision of posterolateral approach to hip joint.^[8,9] Surgical anaesthesia can be achieved with the blockage of all branches of the lumbar and sacral plexuses.

One case report exists of a patient undergoing hemiarthroplasty under transversus abdominis plane (TAP) block in addition to mild intravenous propofol sedation (6.4 mg/kg/h).^[4] In this patient, TAP block was reported to lead to sensorial block between T11 and L3 dermatomes. The extent of sensory blockade in TAP block is also somewhat variable, because it depends on the achieved spread of local anaesthetic and the anatomical course of the nerves being targeted. TAP blocks are generally reported to effect between T7–T9 and T12–L1 dermatomes.^[10] Therefore, TAP block can be insufficient for use in hip surgery.

Lumbar plexus block (LPB) may have been an alternative for this patient.^[11] This is a relatively advanced block that has increased risk of bleeding. Furthermore, LPB is reported to be insufficient when used alone for hip surgeries, as these procedures require sensorial block between T12 and L1 and also sacral plexus.^[9]

ESPB in the lumbar area for hip surgery has been newly described and reported that the lumbar ESP could provide skin anaesthesia up to T12.^[12] We previously demonstrated that local anaesthesia spread from L2 to S1 when ESP was performed from L4 level.^[13] We, therefore, performed ESPB in this patient with the thought that ESP would act like a LPB. Surgical procedures involving the highly innervated hip require combined regional anaesthesia techniques.^[14] Therefore combined nerve block or skin infiltration that would lead to sensorial block between T12 and L1 for cutaneous anaesthesia was also required.

Since most of the innervations in the incision area are coming from the LFCN, incomplete analgesia could be rescued by skin infiltration. QLB was added to ESPB to also block T12 and L1 dermatomes. Tulgar *et al.* previously published their clinical experience on lumbar ESPB demonstrating LA spread anterior to the transverse process, leading to blockage of the lumbar plexus, using radiological imaging. On the other hand, lumbar ESP could fail, as with all plane blocks. Instead of completing a block with infiltrative anaesthesia, we chose the combined block method to predict the combination of the two blocks to increase the effectiveness of one another and to complement the missing aspects.

Paravertebral block from two levels, transversalis fascia plane block, TAP block or QLB block may have been added. The local anaesthetic spread of transmuscular QLB was more appropriate for our patient.^[15]

Transmuscular QLB block might act as an 'indirect paravertebral' because of posterior spread of the injectate to the lumbar paravertebral space and the existing continuity between fascia transversalis and endothoracic fascia allowing further spread to the thoracic paravertebral space.^[15] Transmuscular QLB provides effective post-operative analgesia in the hip surgery. However, there is no literature reporting QLB or ESP for anaesthesia maintenance in hip surgery.

The lumbar plexus is an important part of the sensorial innervations of the hip joint, but contributions come also from sacral plexus: despite this relatively small (and partially negligible for analgesia) contribution, it is still important for surgical anaesthesia. How did we cover this part of the hip innervations? It seems that ESP could have a caudal spread covering the higher part of the sacral plexus.^[13] The mechanism of effect and

dermatomal coverage for each block is not well known. It has been reported that ESP at L4 level should act as a LPB, thus involving nerve fibres for femoral, LFCN and obturator nerve.^[13] However, we use intra-operative analgesics (even if at low dose) and it was associated with insufficient obturator nerve block. This is, of course, a single case, but in this specific case, ESP did not act as a LPB because there was no established quadriceps weakness and missing or insufficient blockage of one of the components. Combining the two blocks should give better anaesthetic covering, but, again, the obturator nerve was not blocked totally, even with the two blocks performed together. Surgical anaesthesia in hip requires the blockage of the nerve to quadratus femoris, superior and inferior gluteal nerve and posterior cutaneous nerve of the thigh and this report leads us to believe all these nerves were blocked.

There are several limitations to our approach in this case. Our local anaesthesia mixture included 150 mg bupivacaine and 240 mg lidocaine which was added so that local anaesthesia effect began earlier. While we were under the toxic doses for both anaesthetic agents, their combined volume may have increased the local anaesthesia systemic toxicity risk. If the patient has cardiac co-morbidities, it would be better with an anaesthetic with a higher safety profile and a longer half-life, such as ropivacaine. However, ropivacaine is not available in our country. Furthermore, although we determined that there was no voluntary movement of the hip joint after blockage, we did not perform a detailed examination of which muscles had been partially or completely paralysed.

To conclude, the combination of lumbar ESPB and transmuscular QLB can be successfully used for the anaesthetic management in high-risk patients undergoing hemiarthroplasty where general or spinal anaesthesia are not safe options.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initial will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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